

Mobilization and Transport of Arsenic in Ground Water Used for Drinking

The Willamette Basin Study Unit proposes to determine factors controlling arsenic mobilization and transport in aquifers used for drinking. The study would address issues central to one of the five primary Cycle II topical studies, "Transport of Contaminants to Public Water-Supply Wells," albeit from a standpoint of domestic wells instead of public supply wells. We submit that the arsenic problem in the United States affects primarily private domestic wells, that this resource is nationally important, and that this issue is deserving of attention because of an absence of mandated monitoring. In other words, we would advocate expanding the primary Cycle II topical study, "Transport of Contaminants to Public Water-Supply Wells," to a broader investigation of ground water resources used for drinking.

Background. The occurrence and distribution of arsenic in ground water of the Willamette Basin (Hinkle and Polette, 1999) recently was assessed as part of an Oregon District cooperative project with Oregon Water Resources Department. Concentrations as high as 2,000 mg/L were measured. Samples from 22 percent of 728 sites (primarily domestic wells) exceeded 10 ug/L. Most of the arsenic appears to be in the relatively toxic trivalent form. It is our opinion that arsenic in ground water is the number one ground water issue in the Willamette Basin.

The District is nearing completion of a detailed, numerical ground water flow model of the Willamette Basin. The model, in combination with a well defined understanding of arsenic occurrence and distribution, places the Willamette Basin Study Unit in a strong position to answer questions regarding mobilization and transport of arsenic in ground water used for drinking.

Goals. The goals of this study are to (1) use geochemical characterization and flow modeling to determine factors controlling mobilization and transport of arsenic in ground water, (2) test our ability to use flow modeling, redox, and geologic data to extrapolate results from well-studied portions of the basin to the more general regional patterns of occurrence and distribution, and (3) contribute data and understanding to a national appraisal of factors affecting arsenic mobilization and transport.

Approach. The work proposed for this component includes the following:

(1) Existing drinking water wells known to contain high concentrations of arsenic would be sampled. Monitoring wells would be installed adjacent to selected wells with high arsenic concentrations to obtain geologic samples and discrete-interval water samples. Water samples would be analyzed for inorganic constituents and redox parameters, including arsenic species. Solid-phase analysis would include X-ray diffraction for mineralogy and by microprobe for elemental analysis. *In situ* injection experiments would be conducted to evaluate the role of competitive sorption on arsenic mobilization under prevailing environmental redox conditions.

(2) Particle tracking results, redox data, and geologic data would be combined into a conceptual model of arsenic mobilization and transport. This conceptual model would be used to extrapolate results from well-studied portions of the Willamette Basin to the more general regional patterns of occurrence and distribution.

References.

Hinkle, S.R., and Polette, D.J., 1999, Arsenic in Ground Water of the Willamette Basin, Oregon: U.S. Geological Survey, Water-Resources Investigations Report 98-4205, 28 p.